CLAIMS

What is claimed is:

1. A method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness, comprising:

preparing semiconductor nano-crystalline anatase TiO_2 sol using titanium alkoxide $Ti(OR)_4$ as a main component in combination with chelating agents in aqueous solution;

dip coating said semiconductor nano-crystalline anatase TiO_2 sol on a surface of a fluorescent lamp tube; and

baking said fluorescent lamp tube coated with said semiconductor nano-crystalline anatase TiO_2 sol to form a photocatalytic coating fluorescent lamp capable of cleaning air;

wherein said baking step is carried out at a low temperature in a range of about 100-250℃;

and wherein when said photocatalytic coating fluorescent lamp is turned on, brightness of said photocatalytic coating fluorescent lamp increases because of a fluorescent property of said semiconductor anatase TiO_2 sol coating, and due to the anatase TiO_2 coating have had visible light photocatalytic ability thereof, a small amount of UV light (UVA) and blue light from the fluorescent lamp is absorbed by said anatase TiO_2 coating, thus generating active species such as electron-hole pairs are capable of cleaning the air.

2. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness as claimed in claim 1, wherein the step of preparing semiconductor nano-crystalline anatase TiO_2 sol using said chelating agents in aqueous solution comprises the following steps:

using acid process to prepare anatase TiO_2 sol; and

adding H_4TiO_4 solution to a H_4TiO_4/ TiO_2 ratio of about 0-10wt%, thereby improving thickness, adhesion, and hardness of said semiconductor

nano-crystalline anatase TiO_2 sol coating.

3. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness as claimed in claim 1; wherein the step of preparing semiconductor nano-crystalline anatase TiO_2 sol using said chelating agents in aqueous solution comprises the following steps:

using alkaline process to prepare anatase TiO_2 sol; and

adding H_4TiO_4 solution to a H_4TiO_4/ TiO_2 ratio of about 0-10wt%, thereby improving thickness, adhesion, and hardness of said semiconductor nano-crystalline anatase TiO_2 sol coating.

4. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness as claimed in claim 1; wherein the step of preparing semiconductor nano-crystalline anatase TiO_2 sol using said chelating agents in aqueous solution comprises the following steps:

using the process to prepare anatase TiO_2 sol; and

adding water solution of precious metal salts or transition metal salt to the anatase TiO_2 sol for the M^{+n} / anatase TiO_2 ratio of about 0-1.0wt%, thereby improving visible light photocatalytic ability for air cleaning.

5. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness as claimed in claim 1; wherein the step of preparing semiconductor nano-crystalline anatase TiO_2 sol using said chelating agents in aqueous solution comprises the following steps:

mixing Eu or rare earth metal salt alcoholic solution with $Ti(OR)_4$ for the Eu^{+3} or rare earth metal.ions. / TiO_2 ratio of about 0 – 1.0 wt%, and

using the process to prepare Eu or rare earth metal doped anatase TiO_2 sol, thereby improving brightness of the fluorescent lamp coated with the anatase TiO_2 sol.

6. The method for fabricating a photocatalytic fluorescent lamp capable of

cleaning air and increasing brightness as claimed in claim 1; wherein the step of dip coating said semiconductor nano-crystalline anatase TiO_2 sol on the surface of said fluorescent lamp tube further comprises the steps of:

dipping a coating frame arranged with an array of fluorescent lamp tubes into said semiconductor nano-crystalline anatase TiO_2 sol by using a coating machine;

dip coating said lamp tubes and readily pulling out said coating frame and said lamp tubes at a fixed pull-out speed of about 10-30 cm/min, wherein said pull-out speed depends on a desired thickness of coating and concentration of said anatase TiO_2 sol;

and wherein the step of baking said fluorescent lamp tube coated with said semiconductor nano-crystalline anatase TiO_2 sol to form a photocatalytic coating fluorescent lamp capable of cleaning air and increasing brightness, further comprises the following steps of:

placing said coated fluorescent lamp tubes and said coating frame into an oven; and

baking said fluorescent lamp tubes to form a photocatalytic coating fluorescent lamp;

wherein said baking process is carried out at a temperature of 150-250℃ for 10-30 minutes, and accurate conditions depend on types of said anatase TiO_2 sol, heat resistance of said fluorescent lamp tubes, hardness of said anatase TiO2 coating, and manufacture throughput.

7. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increasing brightness as claimed in claim 1; wherein the step of dip coating said semiconductor nano-crystalline anatase TiO_2 sol on surface of said fluorescent lamp tube further comprises the steps of:

dipping a coating frame arranged with an array of fluorescent lamp tubes into SiO_2 sol or H_4TiO_4 solution by using a coating machine;

dip coating said fluorescent lamp tubes and readily pulling out said coating frame and said lamp tubes at a fixed pull-out speed of about 10-30 cm/min,

wherein said pull-out speed depends on desired thickness of coating and concentration of said SiO_2 sol or H_4TiO_4 solution;

baking said fluorescent lamp tubes dipped with SiO_2 sol or H_4TiO_4 solution at a temperature of about 50-100℃ for about 10-30 minutes, wherein the advanced SiO_2 sol or H_4TiO_4 solution dipping improves optical properties, adhesion, and hardness of said semiconductor nano-crystalline anatase TiO_2 sol coating;

dip coating said lamp tubes in said anatase TiO_2 sol;

readily pulling out said coating frame and said lamp tubes at a fixed pull-out speed of about 10-30 cm/min, wherein said pull-out speed depends on desired thickness of coating and concentration of said anatase TiO_2 sol;

and wherein the step of baking said fluorescent lamp tube coated with said semiconductor nano-crystalline anatase TiO_2 sol to form a photocatalytic coating fluorescent lamp capable of cleaning air and increasing brightness further comprises the following steps of:

placing said coated fluorescent lamp tubes and said coating frame into an oven; and

baking said fluorescent lamp tubes to form a photocatalytic coating fluorescent lamp;

wherein said baking process is carried out at a temperature of about 150-250℃ for about 10-30 minutes, and accurate condition depends on types of said anatase TiO_2 sol, heat resistance of said fluorescent lamp tubes, hardness of said anatase TiO_2 coating, and designed manufacture throughput.

8. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 1 wherein said fluorescent lamp comprises normal fluorescent lamps, RGB three wave fluorescent lamps, and high frequency fluorescent lamps.

9. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 1, wherein said

fluorescent lamp comprises a straight tube, an annular tube, a U-shaped tube, a spiral tube, and a special dual-layer tube, and wherein when implementing said dip coating step method for fixing said lamp includes a dual head fixing method and a single end fixing method.

10. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 1, wherein before dip coating said semiconductor nano-crystalline anatase TiO_2 sol on the surface of a fluorescent lamp tube, the method further comprises the following steps of:

arranging said fluorescent lamp tube on a coating frame;

washing said fluorescent lamp tube and said coating frame; and

drying said fluorescent lamp tube and said coating frame.

11. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 10, wherein said straight tube dual head fluorescent lamp uses said dual head fixing method, the method further comprising the following steps before arranging said fluorescent lamp tubes on said coating frame:

masking a metal portion at both ends of each said straight tube dual head fluorescent lamps using protection sleeves or thermal plastic sleeves; and

arranging said straight tube dual head fluorescent lamps through holes on said coating frame and fixing said both ends of each said dual head fluorescent lamps by means of a clipping mechanism disposed at an upper plate and lower plate of said coating frame, so that about 1-100 fluorescent lamps can be arranged on said coating frame.

12. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air as claimed in claim 11, wherein said straight tube dual head fluorescent lamps are fixed by using a dual head fixing method, and wherein a method of washing said fluorescent lamp tube and said coating frame comprises dipping said fluorescent lamp tube and said coating frame into solution

containing surfactants for removing oil, followed by rinsing in de-ionized water to removing said surfactants.

13. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 12, wherein said straight tube dual head fluorescent lamps are fixed by using a dual head fixing method, and wherein method for drying said fluorescent lamp tube and said coating frame comprises placing said fluorescent lamp tube and said coating frame into a drying apparatus, and drying said fluorescent lamp tube and said coating frame with heated air.

14. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 13, wherein said straight tube dual head fluorescent lamps are fixed by using a dual head fixing method, and said dried fluorescent lamp tube and said coating frame are subjected to said dip coating step as defined in claim 1.

15. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 14, wherein said straight tube dual head fluorescent lamps are fixed by using a dual head fixing method, and said dried fluorescent lamp tube and said coating frame are subjected to said anatase TiO_2 sol dip coating step as defined in claim 6.

16. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 15, wherein said straight tube dual head fluorescent lamps are fixed by using a dual head fixing method, and said dried fluorescent lamp tube and said coating frame are subjected to said dip coating step as defined in claim 7, after SiO_2 sol or H_4TiO_4 solution dip coating is performed, followed by anatase TiO_2 sol dip coating.

17. The method for fabricating a photocatalytic fluorescent lamp capable of

cleaning air and increase brightness as claimed in claim 8, wherein said single-end fluorescent lamps are fixed by using a single-end fixing method, and a method for arranging said fluorescent lamp tubes on said coating frame comprises:

selecting same type single-end fluorescent lamps or special fluorescent lamps; and

connecting and fixing said the single-end fluorescent lamps to clipping mechanism on said coating frame;

wherein about 1-100 pieces said the single-end fluorescent lamps can be arranged on said coating frame depending on size of said coating frame and pitch thereof.

18. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 17, wherein said single-end fluorescent lamps are fixed by using single-end fixing method, and washing said single-end fluorescent lamps and said coating frame comprises the steps of:

placing said single-end fluorescent lamps and said coating frame in a washing machine;

washing away oil with surfactant solution; and

thereafter washing away surfactant with de-ionized water.

19. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 1, wherein said single-end fluorescent lamps are fixed by using a single-end fixing method, and drying said single-end fluorescent lamps and said coating frame comprises the steps of:

placing said a cleaned single-end fluorescent lamps and said coating frame in a drying machine;

drying said cleaned single-end fluorescent lamps and said coating frame with heated air.

20. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 19, wherein said single-end fluorescent lamps are fixed by using a single-end fixing method, and said dried single-end fluorescent lamp tube and said coating frame are subjected to dip coating step as defined in claim 1.

21. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 20, wherein said single-end fluorescent lamps are fixed by using a single-end fixing method, and said dried single-end fluorescent lamp tubes and said coating frame are subjected to said dip coating step as defined in claim 6.

22. The method for fabricating a photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 21, wherein said single-end fluorescent lamps are fixed by using single-end fixing method, said dried single-end fluorescent lamp tubes and said coating frame are subjected to said dip coating step as defined in claim 7, after SiO_2 sol or H_4TiO_4 solution dip coating is performed, followed by anatase TiO_2 solution dip coating.

23. A photocatalytic fluorescent lamp capable of cleaning air and increase brightness is fabricated by the process as described in claim 1, comprising:

a lamp tube comprising an anatase TiO_2 coating film made of anatase TiO_2 semiconductor nano-crystalline particle packing;

wherein when said photocatalytic fluorescent lamp is turned on, brightness of said photocatalytic fluorescent lamp increases because of a fluorescent property of said anatase TiO_2 coating film, and due to a porous characteristic of said anatase TiO_2 coating film and a visible light photocatalytic ability thereof, a small amount of UV light (UVA) and blue light transmitted from said photocatalytic fluorescent lamp is absorbed by said anatase TiO_2 coating film and active species such as electron-hole pairs that are capable of purifying air

are generated.

24. The photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 23, wherein said anatase TiO_2 coating film is made from anatase TiO_2 sol comprising coagulated said anatase TiO_2 semiconductor nano-crystalline particles with at least about 80% of which are at a particle size below about 20nm.

25. The photocatalytic fluorescent lamp capable of cleaning air and increase brightness as claimed in claim 23, wherein said photocatalytic fluorescent lamp further comprises a base layer coated underneath said anatase TiO_2 coating film, said base layer being made by sol-gel method, and wherein said base layer is made from SiO2 sol or H4TiO4 solution, thereby preventing alkaline ions on a lamp glass tube surface from thermal diffusing out to said anatase TiO_2 coating film to decrease the photocatalytic efficiency, thereby improving optical properties, adhesion, and hardness of said anatase TiO_2 coating film.